

US009638280B2

(12) United States Patent

Nowaczyk et al.

(54) SHOCK ABSORBER WITH FREQUENCY DEPENDENT PASSIVE VALVE

(71) Applicant: Tenneco Automotive Operating

Company Inc., Lake Forest, IL (US)

(72) Inventors: Mark Nowaczyk, Heers (BE); Jelle

Van de Plas, Aarschot (BE); Jan Vochten, Sint-Truiden (BE)

(73) Assignee: Tenneco Automotive Operating

Company Inc., Lake Forest, IL (US)

(*) Notice: Subject to any disclaimer, the term of this

patent is extended or adjusted under 35

U.S.C. 154(b) by 0 days.

(21) Appl. No.: 14/878,397

(22) Filed: Oct. 8, 2015

(65) Prior Publication Data

US 2016/0025181 A1 Jan. 28, 2016

Related U.S. Application Data

- (63) Continuation-in-part of application No. 13/975,454, filed on Aug. 26, 2013, now Pat. No. 9,239,092.
- (51) Int. Cl.

F16F 9/348 (2006.01) F16F 9/50 (2006.01)

F16F 9/512 (2006.01)

(52) U.S. Cl.

CPC F16F 9/5126 (2013.01); F16F 9/348 (2013.01); F16F 9/50 (2013.01)

(58) Field of Classification Search

CPC F16F 9/34; F16F 9/348; F16F 9/512; F16F 9/062; F16F 9/3484; F16F 9/3482;

(Continued)

(10) Patent No.:

(56)

(45) Date of Patent:

References Cited U.S. PATENT DOCUMENTS

1,268,452 A 6/1918 Goodyear

2,640,564 A * 6/1953 Cloudsley F16F 9/3235

(Continued)

US 9,638,280 B2

May 2, 2017

FOREIGN PATENT DOCUMENTS

DE 4327358 A1 10/1994 DE 60210652 T2 8/2006 (Continued)

OTHER PUBLICATIONS

U.S. Appl. No. 14/459,513, filed Aug. 14, 2014, Nowaczyk et al.

Primary Examiner — Bradley King
Assistant Examiner — Stephen Bowes
(74) Attorney, Agent, or Firm — Harness, Dickey &
Pierce, P.L.C.

(57) ABSTRACT

A shock absorber has a pressure tube with a piston assembly slidably disposed within the pressure tube and attached to a piston rod. The pressure tube is disposed within a reserve tube and a working fluid reservoir is formed between the pressure tube and the reserve tube. The piston assembly divides the pressure tube into an upper working chamber and a lower working chamber. A base valve assembly controls a flow of working fluid between the working fluid reservoir and the lower working chamber. The base valve assembly includes a frequency dependent valve system that provides an increased level of damping for each compression stroke of the piston assembly during low frequency movements of the shock absorber. A lesser level of damping is provided for each compression stroke during high frequency movements of the shock absorber.

17 Claims, 7 Drawing Sheets

